

## CLAIMS

What is claimed is:

1. A die for forming a work-piece having a complex geometry, comprising:  
a die insert having an interior surface that defines a first portion of said complex geometry;  
a retainer ring that selectively engages said die insert and includes a circumferential interior surface that defines a second portion of said complex geometry; and  
a punch insert that is slidably disposed in said retainer ring and that includes a surface that defines a third portion of said complex geometry.
2. The die of claim 1 further comprising an adaptor that couples said retainer ring and said punch insert to a forging machine.
3. The die of claim 2 further comprising a first series of resilient members that couple said retainer ring and said adaptor.
4. The die of claim 2 further comprising a second series of resilient members that couple said punch insert and said adaptor.
5. The die of claim 1 further comprising a stopper that extends into said retainer ring to limit sliding movement of said punch insert relative to said retainer ring.

6. The die of claim 5 wherein said punch insert includes a tab formed therein, said tab selectively engaging said stopper to limit sliding motion of said punch insert relative to said retainer ring.

7. The die of claim 1 wherein said die insert includes a relief that slidably receives an end of said retainer ring.

8. A finish pass die that forms a complex geometry into a partially forged work-piece, comprising:

a die insert having an interior surface that defines a first face of said complex geometry;

a retainer ring that is axial movable relative to said die insert between an engaged position and a disengaged position, wherein in said disengaged position said retainer ring radially floats relative to an axis of said die insert and in said engaged position said retainer ring is aligned with and engages said die insert; and

a finish punch insert that is slidably disposed in said retainer ring and that includes a surface that defines a second face of said complex geometry and when said retainer ring is in said engaged position, said partially forged work-piece is sandwiched between said interior surface of said die insert and said surface of said finish punch insert to form said complex geometry.

9. The finish pass die of claim 8 wherein said die insert and includes a circumferential interior surface that defines a circumferential surface of said complex geometry.

10. The finish pass die of claim 8 further comprising an adaptor that couples said retainer ring and said finish punch insert to a forging machine.

11. The finish pass die of claim 10 further comprising a first series of resilient members that couple said retainer ring and said adaptor.

12. The finish pass die of claim 10 further comprising a second series of resilient members that couple said finish punch insert and said adaptor.

13. The finish pass die of claim 8 further comprising a stopper that extends into said retainer ring to limit sliding movement of said finish punch insert relative to said retainer ring.

14. The finish pass die of claim 13 wherein said finish punch insert includes a tab formed therein, said tab selectively engaging said stopper to limit sliding motion of said finish punch insert relative to said retainer ring.

15. The finish pass die of claim 8 wherein said die insert includes a relief that slidably receives an end of said retainer ring.

16. A multi-pass forging machine that forms a complex geometry into a work-piece, comprising:

a first pass die that partially forms said work-piece; and

a finish pass die that forms said complex geometry in said partially formed work-piece, said finish pass die comprising:

a die insert having an interior surface that defines a first portion of said complex geometry;

a retainer ring that selectively engages said die insert and includes a circumferential interior surface that defines a second portion of said complex geometry; and

a finish punch insert that is slidably disposed in said retainer ring and that includes a surface that defines a third portion of said complex geometry.

17. The multi-pass forging machine of claim 16 further comprising an adaptor that couples said retainer ring and said finish punch insert to a forging machine.

18. The multi-pass forging machine of claim 17 further comprising a first series of resilient members that couple said retainer ring and said adaptor.

19. The multi-pass forging machine of claim 17 further comprising a second series of resilient members that couple said finish punch insert and said adaptor.

20. The multi-pass forging machine of claim 16 further comprising a stopper that extends into said retainer ring to limit sliding movement of said finish punch insert relative to said retainer ring.

21. The multi-pass forging machine of claim 20 wherein said finish punch insert includes a tab formed therein, said tab selectively engaging said stopper to limit sliding motion of said finish punch insert relative to said retainer ring.

22. The multi-pass forging machine of claim 16 wherein said die insert includes a relief that slidably receives an end of said retainer ring.